MEASURING ENTERPRISE RESOURCE PLANNING (ERP) SYSTEMS SUCCESS FROM A MANAGERIAL ACCOUNTING PERSPECTIVE

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Abstract

A major objective of management accounting is to support managers in decision-making by providing decision-relevant interdepartmental information. Hence, enterprise resource planning (ERP) systems are important for the application of management accounting techniques as they streamline the necessary information. Besides the fact that ERP systems are important, there was little research conducted which is directly concerned with concrete benefits that arise with the use of ERP systems within management accounting. This study with 94 participants contributes to this research field by examining benefits that arise with the use of ERP systems within management accounting and the characteristics that are crucial for achieving those benefits. As there was a recent wave of new ERP systems (i.e., SAP S/4HANA®), the results were clustered into organizations that are using traditional and modern ERP system where appropriate (i.e., response time). The outcomes indicate that using ERP systems within management accounting offers benefits that are positively interrelated with the extent and the satisfaction of using this information to make decisions. As a higher extent of using this information and a higher degree of satisfaction with this information is positively interrelated with organizational performance, we show that using ERP systems within management accounting helps improve organizational performance.

Keywords: Enterprise Resource Planning Systems, Management Accounting, I/S Success Model, Empirical Research

Authors' individual contribution: Conceptualization — P.U.; Methodology — P.U. and H.A.G.; Formal Analysis — H.A.G.; Writing — Original Draft — P.U. and H.A.G.; Writing — Review & Editing — P.U. and H.A.G.; Visualization — P.U. and H.A.G.; Supervision — P.U. and H.A.G.

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1. INTRODUCTION

Management accounting is concerned with supporting managers in the decision-making process by providing decision-relevant information (Hyvönen, 2003). As the application of management accounting techniques contains interdepartmental information, enterprise resource planning (ERP) systems are often used in this area (Davenport, 1998). Despite the necessity of ERP systems in order to apply management accounting techniques, there is little research conducted which elaborates the success to companies that is being achieved through using ERP systems within management accounting. Research that have been conducted by Holsapple, Sena, and Wagner (2017) examine

decision-support that arises with ERP systems by adopting decision support systems (DSS) research frameworks. Besides this research, Shang and Seddon (2000, 2002) have elaborated and examined ERP benefit constructs in their framework. While these research papers offer important benefit aspects that were considered in this study, there were no insights into characteristics that were critical to achieving decision-support or ERP benefits. As we intend to also answer this question, we utilized the frequently cited information systems (I/S) success framework of DeLone and McLean (1992, 2003) which we call the D&M I/S success model in the following. This model proposes that certain system, information, and service characteristics are critical to achieving benefits to the company by increasing the extent to which I/S were used and to which the users of I/S are satisfied with the I/S.

The remainder of the paper is structured as follows. Section 2 describes the relationship between I/S and management accounting. Section 3 discusses frameworks that are concerned with measuring I/S success. In Section 4, the methodology of this study is presented which includes the derivation of the framework that is applied in this study. The characteristics of the sample and the results of this study are presented and discussed in Section 5. After discussing limitations of the study in Section 6, this paper ends with the conclusion in Section 7.

2. INFORMATION SYSTEMS AND MANAGEMENT ACCOUNTING

Information Technology (IT) impacts roles of management accountants (Scapens & Jazayeri, 2003; Chang, Ittner, & Paz, 2014), very often researched in the context of ERP systems (O'Mahony & Doran, 2009; Scapens & Jazayeri, 2003). In the field of management accounting, studies on the influences of information systems have been carried out for about 50 years. In the beginning, the main focus was on decision support systems (DSS), then on management support systems. In the last 10 years, the term "business intelligence" — the intelligent use of information systems to better achieve the business purpose — has been increasingly used (Rom & Rohde, 2007). In this context, business intelligence is based on the use of ERP systems in the background. The data is archived in a central data warehouse and is then available for OLAP evaluations and data mining. In recent years, research on information systems and management accounting has focused almost exclusively on ERP systems (Spraakman, O'Grady, Askarany, & Akroyd, 2018).

3. INFORMATION SYSTEMS SUCCESS FRAMEWORKS

Similar to the vast majority of preceding studies in this context, this study conducts the I/S success model of DeLone and McLean (1992, 2003). In their pioneering model, the authors developed a comprehensive, multidimensional model of I/S success based on the communication research of Shannon (1948), the information influence theory of Mason (1978) as well as the literature review of 180 empirical management information systems studies from 1981 until 1987. After initially developing the model in 1992 (DeLone & McLean, 1992), DeLone and McLean have updated their model in 2003 (DeLone & McLean, 2003). According to Shannon (1948), the technical level is the accuracy and efficiency of the system which produced the information, the semantic level is the success of the information in conveying the intended meaning and the effectiveness is the effect of the information on the receiver. Mason (1978) relabels effectiveness to influence and defines certain sub-categories. Influence is a series of events including the receipt of the information and the evaluation and application of the information which leads to a change in the recipient's behavior and a change in system performance (Mason, 1978). The primary model of DeLone and McLean (1992) combine the models of Shannon (1948) as well as Mason (1978) in order to "synthesize previous research involving I/S success into a more coherent body of knowledge and to provide guidance to future researchers" (DeLone & McLean, 2003, p. 60). The updated D&M I/S success model of DeLone and McLean (2003) adds service quality as a distinct dimension, clarifies the dimension of use, and combines individual impact and organizational impact to the single dimension of net benefits. The success dimensions can be defined as follows (Petter & McLean, 2009):

– System Quality is the quality of the information-producing system itself.

– Information Quality determines the characteristics of the output offered by the I/S.

– Service Quality is the support of users by the I/S department.

– Intention to Use is the expected future consumption of an I/S or its output.

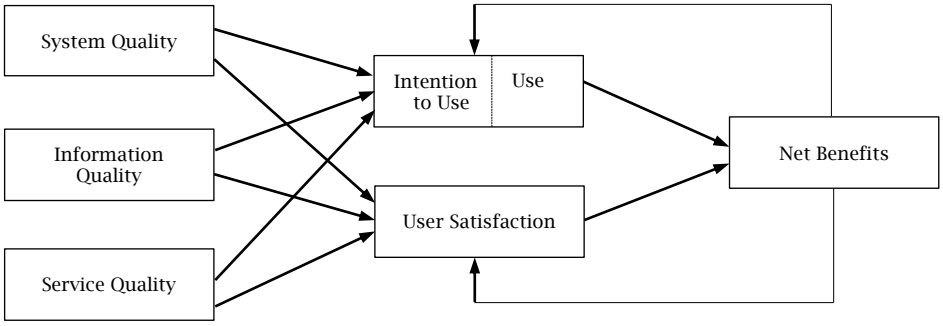
– Information Use in the context of this study is the actual consumption of the I/S output.

– User Satisfaction is the approval or likeability of an I/S and its output.

– Net Benefits describes the effect that an I/S has on an individual, group, organization, industry, society, etc.

Preceding studies have suggested additional I/S impact categories such as workgroup impacts (Myers, Kappelman, & Prybutok, 1997; Ishman, 1998), inter-organizational and industry impacts (Clemons, Reddi, & Row, 1993), consumer impacts (Hitt, Brynjolfsson, & Walsham, 1994; Brynjolfsson, 1996), and societal impacts (Seddon, 1997). DeLone and McLean (2003) state that the additional categories may be appropriate for some studies, depending on the context. However, as the term impact may be good or bad and thus could lead to confusion whether the results are good or bad, the term of benefit was preferred as it implies a good result (DeLone & McLean, 2003). As a benefit is not assumed to be wholly positive as some negative consequences may appear, the inclusion of "net" is important (DeLone & McLean, 2003). Rather than being independent, the model suggests that the dimensions are interrelated which is illustrated below.

Figure 1. Interrelations within the D&M I/S model



The arrows in Figure 1 illustrate the proposed interrelations between the success dimensions but do not suggest causal associations (positive or negative signs for those associations) as they should be hypothesized within the context of a particular study (DeLone & McLean, 2003). Literature reviews of Petter, DeLone, and McLean (2008) and Petter and McLean (2009) provide empirical support for many of these proposed relationships which will be discussed in more detail in the hypotheses section.

4. RESEARCH DESING

4.1. Methodology

The objectives of this study are both measuring the success of using ERP systems within management accounting from a management control perspective and the validation of interrelationships between the D&M I/S success dimensions. Similar to the methodology of preceding research, a quantitative approach has been conducted. Descriptive statistics measure the extent to which ERP systems offer benefits along the success dimensions. A five-point Likert scale was used within the survey. Literature review indicates that interrelationships were mostly analyzed by computing correlations in preceding studies (Petter et al., 2008; Petter & McLean, 2009). Just a few researchers such as Hsiao-Hui Wang and Chen (2011) have also conducted a regression analysis to elaborate interrelationships between the success dimensions. We agree that correlations coefficients indicate the extent to which two variables move together. Therefore correlation coefficients will also be computed in this study in order to compare the outcomes with previous research. However, correlation coefficients cannot indicate which impact a unit change of an independent variable has on a dependent variable in this framework. This however can be answered by conducting regression analysis. Therefore, this study applies multiple linear regression analysis additional to correlation coefficients. The arrows between the success dimensions in Figure 1 represent the regression analysis paths. As linear regression analysis has several prerequisites, the sample was analyzed for the following characteristics. In order to avoid misinterpretations of the regression outcomes outliers which were exceeding a cut-off value of 3 standard deviations were erased from the sample (Rousseeuw & van Zomeren, 1990). Furthermore, the sample was tested for auto-correlation with the Durbin-Watson test (Durbin & Watson, 1950). As multicollinearity may increase the variance of coefficient estimates and makes them sensitive to minor changes in the model, estimates can become unstable and difficult to interpret we also tested the sample for multicollinearity (Mansfield & Helms, 1982). Thus, besides controlling the correlation coefficients, variance inflation factors (VIFs) were computed in the regression analysis section which supports detecting possible multicollinearity according to Manfield and Helms (1982). The survey was pre-tested by business managers with ERP experiences.

4.2. Constructs and variables of the study

The survey consists out of the seven (7) constructs (*System Quality*, *Information Quality*, *Service Quality*, *Intention to Use*, *Information Use*, *User Satisfaction*, and *Net Benefits*) of the D&M I/S success model. Researchers conducting the D&M I/S success model are asked to use existing and validated measures rather than defining new measures to make results comparable and findings possible to validate (DeLone & McLean, 1992, 2003). As the constructs of the D&M I/S success framework are flexible depending on the context of the research that is conducted, aspects of other frameworks such as the ERP benefits framework of Shang and Seddon (2000) or the accounting information criteria of Snavely (1967) were integrated into the D&M I/S success model in order to operationalize the constructs appropriately to the context of this study. The operationalization of these variables will be discussed below. An entire overview of the variables can be found in the descriptive results subsection within the results section as a table in this subsection would be redundant to the information that is provided there.

System Quality is measured according to the study of Bailey and Pearson (1983). Especially the flexibility of the system is regarded as an important measure, as in times of digitization and increasing frequency of changes in markets, information systems must be able to react quickly to new business processes or even business models (Haddara & Elragal, 2011). Similar to King and Epstein (1983), this study measures *Information Quality* based on the accounting information criteria of Snavely (1967). According to these criteria, six-second level criteria (relevance, reliability, understandability, significance, sufficiency, and practicability) must be fulfilled to fulfill the first level criterion of information usefulness (Snavely, 1967). In the context of this study, information is relevant when it assists the decision-making process of the management. Information that is relevant is not necessarily significant as the inclusion of significant information affects decisions (Snavely, 1967). Reliability in this context is verifiable

information that is free from bias (Snavely, 1967). Understandable information according to Snavely (1967) is quantified (where possible), comparable (e.g., with different periods or other companies), and simple (as humans can only process a limited count of information) that is being communicated as much as possible in a way how the information users expect the information to be communicated (consistency with user concepts). The availability of relevant information for decision-making does not automatically imply a sufficient quantity of information, as too little or too much information may both have a negative impact on decisions (Snavely, 1967). The practicality of information to this study is information that is provided timely and that information is worth more than it costs to prepare (Snavely, 1967). A common way to measure *Service Quality* is the SERVQUAL instrument (Pitt, Watson, & Kavan, 1995). According to Pitt et al. (1995), service quality is measured through tangibles (physical facilities, equipment, and appearance of personnel), reliability (ability to perform the promised service dependably and accurately), responsiveness (willingness to help customers and provide prompt services), assurance (knowledge and courtesy of employees and their ability to inspire trust and confidence) and empathy (caring, individualized attention the service provider gives its customers). The literature review of DeLone and McLean (1992) shows that *Information Use* is measured both ways, absolutely and relatively in prior studies. Regarding absolute measures, indication questions such as the frequency of use, the number of minutes using I/S, number of queries, or extent of use can be identified (DeLone & McLean, 1992). Barki and Huff (1985) are measuring information use by capturing the percentage of time DSS are used in decision-making processes. This relative measure is appropriate in the context of this study as it gives insights into how intensively management accounting information are actually considered in decision-making processes rather than measuring how many reports have been created that may not all be relevant and thus not considered by decision-makers (information overload). According to Cameron and Whetten (1983), it is important to define from whose perspective *User Satisfaction* is measured. In this study, *User Satisfaction* is measured from the perspective of the business managers. Similar to *User Satisfaction*, the perspective from which *Net Benefits* are measured needs to be defined before defining the actual benefit items (DeLone & McLean, 2003). This paper is concerned with the benefits that arise with the application of management accounting processes by using ERP systems for the support of decision-makers. Therefore, *Net Benefits* are measured from a management control perspective. According to Anthony (1965), management control is the assurance "that resources are being used effectively and efficiently in the accomplishment of the organization's objectives" (p. 17). To define the benefit items, the ERP benefit framework (Shang & Seddon, 2000, 2002) was considered as it offers multiple survey items that are measuring ERP-related benefits. According to Shang and Seddon (2000, 2002), senior managers are reliable informants to identify strategic benefits, IT managers for IT infrastructure benefits, and business managers for managerial, operational, and organizational benefits. As this study is focused on business managers, managerial, operational, and organizational benefits were further considered. After having analyzed these remaining clusters, we decided not to break down *Net Benefits*. Even though organizational benefits could be distinguished from the other clusters, there were several conflicts identified between *Information Quality*, managerial and operational benefits. One of these conflicts is concerned with *Information Quality* and operational benefits. Reliability and accuracy of data is a component of operational benefits which is however already considered within the *Information Quality* dimension by applying the accounting information criteria (Snavely, 1967). Therefore, it would be redundant to consider data accuracy as an operational benefit. Apart from that, we do not think that the provision of decision-relevant information at an appropriate quality level is not a benefit but rather an objective of management accounting that supports decision-making (Coombs, Hobbs, & Jenkins, 2005). We interpret *Net Benefits* as the outcomes that arise with the use of I/S (DeLone & McLean, 2003). *Net Benefits* in the context of this study are concerned with benefits that arise along the decision-making process. Thus, these benefits can arise while gathering decision-relevant information (e.g., cycle times of management accounting tasks), benefits that arise for taking decisions (e.g., confidence in decisions), and with decision outcomes (e.g., financial improvement).

4.3. Hypotheses

As there are preceding studies that also measured the interrelationship between success dimensions, hypotheses were derived. Researchers are asked to study interactions of the I/S success dimensions carefully (DeLone & McLean, 1992). Comparing the outcomes of literature reviews over the years, the count of studies analyzing the interrelationships of the success dimensions has increased (DeLone & McLean, 2003; Petter et al., 2008; Petter & McLean, 2009). Petter and McLean (2009) have performed a meta-analysis of preceding studies analyzing the relationship itself as well as the magnitude of the relationship between D&M I/S success dimensions. The literature review considered studies from an individual as well as an organizational point of view. As this study is focused on the point of view of managers at a managerial control level, the outcomes of studies from an individual point of view were considered. The relationship between the success dimensions was analyzed by computing the correlation coefficients (r). The magnitude of the relationship between the dimensions was analyzed regarding the effect size. The results of the meta-analysis are illustrated in Table 1. The magnitude of relationships was judged by using Cohen's (Cohen, Cohen, West, & Aiken, 2003) heuristics, where $r \geq 0.5$ is strong, $0.3 \leq r < 0.5$ is moderate and $0.1 \leq r < 0.3$ is weak. The literature review of Petter et al. (2008) classifies the outcomes of the level of support for each relationship in strong, moderate, and mixed support. Strong support was assigned when the percentage of papers with a positive result was in the range of 90–100%, moderate support in the range of 67–83%, and mixed support with a range of 25–53% (Petter et al., 2008). If there were only three or fewer studies analyzing the interrelationship between two success factors, this interrelationship was classified as insufficient

data (Petter et al., 2008). Other to the literature reviews mentioned above the meta-analysis of Sabherwal, Jeyaraj, and Chowa (2006) did not include both *Information Quality* and *Service Quality* as these dimensions were not part of their theoretical model. The outcomes of the most recent literature reviews considering the updated D&M I/S success model are illustrated in Table 1.

Table 1. Empirical interdependencies between the D&M I/S success dimensions

Relationship	*Petter and McLean (2009)*	*Petter et al. (2008)*	*Sabherwal et al. (2006)*
System Quality → Use	Moderate support	Mixed support	Significant
System Quality → Intention to Use	Strong support	Not examined	Not examined
System Quality → User Satisfaction	Strong support	Strong support	Significant
System Quality → Net Benefits	Not examined	Moderate support	Significant
Information Quality → Intention to Use	Strong support	Not examined	Not examined
Information Quality → Use	Moderate support	Mixed support	Not examined
Information Quality → User Satisfaction	Strong support	Strong support	Not examined
Information Quality → Net Benefits	Not examined	Moderate support	Not examined
Service Quality → Use	No significant results	Insufficient data	Not examined
Service Quality → User Satisfaction	No significant results	Mixed support	Not examined
Service Quality → Net Benefits	Not examined	Moderate support	Not examined
Use → User Satisfaction	Weak support	Moderate support	Not examined
Use → Net Benefits	Moderate support	Moderate support	Significant (correlation)
User Satisfaction → (Intention to) Use	Strong support	Moderate support	Not significant
User Satisfaction → Net Benefits	Strong support	Strong support	Not examined
Net Benefits → (Intention to) Use	Strong support	Moderate support	Significant (correlation)
Net Benefits → User Satisfaction	Not examined	Strong support	Not significant

The results of the literature reviews support many interrelationships that DeLone and McLean (2003) proposed at different contexts of research. The interrelationships between *System Quality* and *User Satisfaction* as well as *Information Quality* and *User Satisfaction* are particularly strong. However, no such interrelationship of *Service Quality* dimensions could be validated in any of these literature reviews. Besides the young phase of this dimension compared to other existing success dimensions at the time of these literature reviews, the low degree of comprehensiveness and consistency of *Service Quality* measures may be possible reasons for these outcomes (Petter et al., 2008). Petter et al. (2008) criticize that most of the reviewed studies still tend to focus on some of the success dimensions instead of conducting a more comprehensive approach with regard to all of the success dimensions as demanded from DeLone and McLean (2003). As a consequence, this study aims at the validation of the proposed interrelationships of the success dimensions in the context of the use of ERP systems within management accounting. Thus, the proposed interrelationships between the success dimensions of DeLone and McLean (2003) serve as the basis for the derivation of hypotheses. The hypotheses are listed in Table 2.

Table 2. Hypotheses of this study

Hypotheses	*Description*
H1	There is a significant, positive relationship between *System Quality* and *Intention to Use.*
H2	There is a significant, positive relationship between *Information Quality* and *Intention to Use.*
H3	There is a significant, positive relationship between *Service Quality* and *Intention to Use.*
H4	There is a significant, positive relationship between *System Quality* and *User Satisfaction.*
H5	There is a significant, positive relationship between *Information Quality* and *User Satisfaction.*
H6	There is a significant, positive relationship between *Service Quality*and *User Satisfaction.*
H7	There is a significant, positive relationship between *User Satisfaction* and *Intention to Use.*
H8	There is a significant, positive relationship between *Use* and *User Satisfaction.*
H9	There is a significant, positive relationship between *Use* and *Net Benefits.*
H10	There is a significant, positive relationship between *User Satisfaction* and *Net Benefits.*
H11	There is a significant, positive relationship between *Net Benefits* and *Intention to Use.*
H12	There is a significant, positive relationship between *Net Benefits* and *User Satisfaction.*

5. RESULTS

5.1. Sample

The survey link was mailed to 11,207 European organizations. Excluding undeliverable mails, 10,103 organizations were invited to participate in the survey. One hundred and one (101) participants have responded to the online survey. As indicated above, the sample was controlled for outliers before interpreting the regression results. As 7 outliers were identified which exceeded the cut-off value of 3 standard deviations, the actual sample size was 94. Thus, the participation rate was at about 1%. The participants were asked for the employee count and the revenues of the past fiscal year. Three (3) enterprises in the sample occupied 1–30 employees in the past fiscal year, 24 occupied 31–30, 37 occupied 301–3,000 and 28 occupied more than 3,000 employees. Three (3) enterprises generated 1–6 million euros in the past fiscal year, 16 entrprises generated 7–60 million euros, 36 generated 61–600 and another 37 enterprises generated more than 600 million euros. More than one third (33) of the participating enterprises were operating in the Manufacturing industry, 17 in Services, 14 in Wholesale, Retail, and Trading, in each case 2 in Finance, Banking, and Insurance, Hotels and Catering, Properties, Telecommunication, Utility and 1 in the Transportation industry. While 16 participants stated to operate in another industry, 3 participants did not answer this question. Participants were also asked for the ERP system that is used for applying management accounting processes in their

enterprise. The results strongly demonstrate the leading role of SAP® as 67 of the 94 participants (71%) use one of their ERP products. The full distribution list is listed below.

Table 3. ERP systems used by the enterprises within management accounting

Qty	*ERP*
28	SAP R/3®
23	SAP ERP®
12	SAP S/4HANA®
8	Microsoft Dynamics®
4	DATEV®
4	SAP Business by Design®
2	Sage Business Cloud Enterprise Management®
2	Schleupen CS®
2	In-house development
9	Other

5.2. Descriptive results

The descriptive results which are listed in Table 4 indicate moderate to strong mean values along the success constructs based on a five-point Likert scale which was used for measuring the extent to which the benefit items occur.

The overall *System Quality* falls below the overall mean value of this study which indicates certain areas of improvement. The highest degree of satisfaction was achieved within the convenience of accessing the ERP systems as well as the transactional response time of management accounting activities such as direct postings or cost settlements. However, the participants were mostly not pleased with the flexibility of their ERP system when adopting new business processes or integrating acquired companies into the ERP landscape. While the participants were mostly pleased with the transactional response time, the satisfaction with analytical response time fell below the *System Quality* average rate. As the output of management accounting is often presented in terms of reports, analytical response time is critical for the cycle time of management accounting processes. Modern ERP software such as SAP S/4HANA® offers faster database technologies which lead to shorter response times (Krüger, 2016). The participants confirm the improvement of the database as the analytical response time showed $m = 4.08$ on average compared to an overall mean value of $m = 3.45$. However, no such improvement was identified when it comes to the flexibility of the ERP system to new business processes. This finding confirms the complexity of setting up and using ERP systems (Janssens, 2017).

Table 4. Descriptive results

Construct	*Variable(s)*	*M*	*SD*
System Quality	Flexibility of the ERP system	2.73	1.09
System Quality	Convenience to access the ERP system	3.91	0.84
System Quality	Integration of the ERP system	3.65	0.92
System Quality	Transactional response time of the ERP system	3.90	0.81
System Quality	Analytical response time of the ERP system	3.47	0.96
System Quality overall		3.54	0.60
Information Quality	Practicality of provided information	3.82	0.58
Information Quality	Relevance of provided information	4.07	0.78
Information Quality	Reliability of provided information	3.88	0.74
Information Quality	Significance of provided information	4.00	0.64
Information Quality	Sufficiency of provided information	3.99	0.66
Information Quality	Understandability of provided information	3.51	0.72
Information Quality overall		3.80	0.47
Service Quality	Reliability of the service department	3.69	0.75
Service Quality	Responsiveness of the service department	3.11	0.90
Service Quality	Assurance of the service department	3.95	0.74
Service Quality	Empathy of the service department	3.70	0.60
Service Quality overall		3.61	0.63
Use	Extent to which ERP information is considered in decision-making	3.91	0.99
User Satisfaction	Extent to which information needs were met	3.45	0.69
User Satisfaction	Satisfaction with the cycle time to make decisions based on provided information	3.53	0.72
User Satisfaction overall		3.50	0.62
Intention to Use	Voluntariness to use ERP system information	2.94	1.06
Intention to Use	Behavioral intention to use ERP system information	4.14	0.79
Intention to Use overall		3.54	0.64
Net Benefits	Ex post satisfaction with taken decisions	3.71	0.61
Net Benefits	Confidence in decisions	3.86	0.70
Net Benefits	Extent of occupied employees in providing information	2.80	1.03
Net Benefits	Financial improvement	3.74	0.76
Net Benefits	Labor cost reduction	3.13	1.04
Net Benefits	Product (inventory) cost reduction	3.40	1.04
Net Benefits	General administrative cost reduction	3.43	1.00
Net Benefits	Satisfaction with management reporting cycle time	3.45	1.00
Net Benefits	Satisfaction with product costing/inventory valuation cycle time	3.48	0.97
Net Benefits	Satisfaction with cost accounting cycle time	3.83	0.72
Net Benefits	Satisfaction with planning and budgeting cycle time	2.87	1.10
Net Benefits	Satisfaction with forecasting cycle time	3.46	1.00
Net Benefits	Empowerment of management accounting staff to take part in decision-making	2.86	0.85
Net Benefits	Interdisciplinary co-ordination	4.04	0.78
Net Benefits	Interdepartmental harmonization of processes	3.80	0.86
Net Benefits	The ability of the workforce to learn and use ERP functionalities in their work routine	3.76	0.71
Net Benefits	Quickness of staff to learn and use ERP functionalities in their work routine	3.53	0.92
Net Benefits overall		3.47	0.49
Overall mean		3.59	0.39

Notes: The variables were measured on a five-point Likert scale ranging from 1 (very low or totally disagree) to 5 (very high or totally agree).

As *Information Quality* was measured through the accounting information criteria of Snavely (1967), the results of this construct will be presented along with the criteria items. Practicality was measured through the timeliness ($m = 3.91$) and the cost-benefit ratio of the provided information ($m = 3.73$). The reliability of the provided information was measured through verifiability ($m = 4.15$) and objectiveness ($m = 3.58$). The discrepancy between the verifiability and the objectiveness supports the distinction in the framework of Snavely (1967) as verifiable information does not automatically imply objectiveness. The high mean value of relevance indicated that most managers were satisfied with the information that is provided for decision-making. This does also apply to the almost identical mean values of significance and sufficiency. However, the understandability of information may be improved as the mean value substantially differs from the other measures mentioned above. According to Snavely, the understandability of information consists out of quantifiability, appropriate illustration, comparability, and simplicity of information (Snavely, 1967). Assuming that management accounting information is quantified by default, we measured the illustration, comparability, and simplicity in this study. A large gap between the comparability ($m = 3.92$), simplicity ($m = 3.55$) and satisfaction with the illustration of information ($m = 3.09$) was identified. Regarding the illustration of information, one may argue that ERP systems are traditionally transaction-oriented information systems while the illustration of information is made by other software such as business intelligence tools (Granlund & Malmi, 2002; Hyvönen, 2003). However, modern ERP software with new technologies such as data analytics, real-time information processing, or embedded Business Warehouse tools are becoming more suitable for analytical tasks and thus supporting decision-making (Davenport, 2014; Holsapple et al., 2017). This is also demonstrated in the results as the mean value of SAP S/4HANA® ($m = 3.17$) substantially surpasses previous ERP software of SAP ($m = 2.97$ for SAP R/3® and $m = 3.04$ for SAP ERP®).

The overall *Service Quality* mean ($m = 3.61$) of the ERP-related service department was slightly above the overall average in this study. The assurance of the *Service Quality* achieved a significantly higher mean value ($m = 3.95$) which indicates a high satisfaction of the participants with the know-how of the service department staff. While reliability, assurance, and empathy of the service department achieved above-average scores, the responsiveness of the service department was evaluated substantially below these measures. The responsiveness of the service department was measured through the promptness of the provided services and the time to receive answers on user requests which indicates the degree of utilization of the service department. In particular, the participants indicated that it takes too much time to receive answers to their requests from the service department ($m = 2.97$).

The use of ERP system information from management accounting achieved the highest mean value in the entire survey. Use was measured by indicating, how often (in %) ERP system information from management accounting was considered in decision-making. The answers were measured on a five-point Likert scale (1 = 0–20%, 2 = 21–40%, 3 = 41–60%, 4 = 61–80%, 5 = 81–100%). Even though the use criterion achieved the highest mean value in this study, *User Satisfaction* and *Intention to Use* fell below the mean value of this study. Perhaps measuring the voluntariness to use ERP system information from management accounting is not appropriate in the context of this study as, other to some information systems, the use of ERP system techniques is mandatory for applying management accounting techniques.

As the measures of *Net Benefits* cover a wide range within a company, the spread between the mean values (2.80 to 4.04) is not surprising. A major objective of ERP systems according to Davenport (1998) is to streamline information flows from different departments. Thus, the high mean values of the interdisciplinary co-ordination ($m = 4.04$), as well as the harmonization of interdepartmental processes ($m = 3.80$), were not unexpected. Even though the provided information does not perfectly meet the information needs of decision-makers ($m = 3.45$), the confidence in the decisions achieved a high mean value ($m = 3.86$). However, as the ex-post satisfaction with the decisions differs from this, there might be an overconfidence bias which leads to higher mean values in the confidence in decisions. The financial aspects of decision outcomes indicate that the decisions rather impact the overall profitability or revenues than reduce costs within the company. The satisfaction with the cycle time of operational management accounting tasks showed significant differences depending on the tasks. As management reporting provides aggregated information based on transactional data, the similarity of the mean values between the analytical response time of the ERP system ($m = 3.47$) and the cycle time of management reporting ($m = 3.45$) appears plausible. A similar observation was made between the more transactional oriented cost accounting cycle time ($m = 3.83$) and the transactional response time of the ERP system ($m = 3.90$). The recent database improvements mentioned above in the *System Quality* section seem to significantly improve the cycle time of management reporting ($m = 3.91$ for SAP S/4HANA®). Even though the ERP system is not the only information system where planning is conducted, some operational planning such as cost center planning is usually fulfilled in most companies. As the transactional response time is significantly higher, it is assumed that the low mean value of operational planning and budgeting ($m = 2.87$) is mostly related to the process-wise approach that is conducted. Empirical studies indicate that the cycle time of a top-down approach in operational planning and budgeting is significantly lower compared to other approaches (Horváth & Partners, 2013, 2015). The Institute of Management Accounting (IMA, 2013) as well as the International Group of Controlling (IGC, 2013) both propose a transition of the role of management accountants towards a business partners who not only supply decision-relevant information but also consult decision-makers in the decision-making process. The use of ERP system information serves as a technical basis for management accountants to take in this role. However, the low mean value

($m = 2.86$) indicates that it will take more time to fulfill the transition of the role of management accountants in most of the companies who participated in this survey. The correlations which are illustrated in Table 5 were computed for examining the sample for multicollinearity as well as comparing the results with the literature review outcomes.

Table 5. Pearson's correlations

	1)	*2)*	*3)*	*4)*	*5)*	*6)*	*7)*
1) System Quality	1						
2) Information Quality	0.450**	1					
3) Service Quality	0.466**	0.558**	1				
4) Intention to Use	0.165	0.142	-0.065	1			
5) Use	0.122	0.254*	-0.059	0.554**	1		
6) User Satisfaction	0.412**	0.619**	0.457**	0.272**	0.104	1	
7) Net Benefits	0.420**	0.549**	0.392**	0.140	0.060	0.592**	1

*Notes: ** Correlation is significant at the 0.01 level (2-sided). * Correlation is significant at the 0.05 level (2-sided).*

According to Farrar and Glauber (1967), correlation coefficients should not exceed a rule of thumb value of $r = 0.8$ or $r = 0.9$ in order to deny multicollinearity. As the correlation coefficients in this study are lower than $r = 0.8$, multicollinearity can be denied. However, as indicated in the methodology section, VIF factors were computed in the regression analysis section which is also helpful for detecting any possible multicollinearity according to Mansfield and Helms (1982). In order to compare the magnitude of interrelationships with the meta-analysis of Petter, Cohen's (Cohen et al., 2003) heuristics to interpret correlation coefficients were considered, where $r \geq 0.5$ is strong, $0.3 \leq r < 0.5$ is moderate and $0.1 \leq r < 0.3$ is weak. According to the results in Table 5, *Information Quality* and *User Satisfaction* have the strongest significant positive relationship among all constructs which leads to the second-highest relationship between *User Satisfaction* and *Net Benefits*. This finding is in line with those of Petter et al. (2008) and Petter and McLean (2009) and therefore strongly supports the interrelationships that DeLone and McLean (2003) proposed in their framework. Based on the two strongest interrelationships it is not surprising that *Information Quality* is directly strongly interrelated with *Net Benefits* even though this interrelationship is not explicitly proposed by DeLone and McLean (2003). Other than the review results of Petter et al. (2008) and Petter and McLean (2009), this study finds some support for the proposed impact of *Service Quality* on the overall ERP system success within management accounting. The strongest relationship that is related to information however is not part of the framework of DeLone and McLean (2003) as the quality aspects were proposed to impact *Intention to Use* and *User Satisfaction*. However, there is a moderate relationship between *Service Quality* and *User Satisfaction*. As *User Satisfaction* is strongly interrelated with *Net Benefits*, *service quality*, in turn, is also positively interrelated with *Net Benefits*.

Contrary to the findings of Petter et al. (2008) and Petter and McLean (2009), the proposed interrelationship between quality characteristics and *Intention to Use* could not be confirmed in this study. As indicated in the descriptive results section, the construct of *Intention to Use* may be inappropriate for information systems that are mandatory to use in order to apply certain tasks or techniques such as management accounting techniques. The outcomes give little support to this as *Information Quality* and *Service Quality* are stronger (but mostly not significantly) interrelated with *Use* than with *Intention to Use*. However, *System Quality* is higher interrelated with *Intention to Use* compared to *Use*.

As the hypotheses were tested based on correlation statistics in previous research, they were also tested based on the results in Table 5 for reasons of comparability. The results of the correlation analysis indicate that 7 out of the 12 formulated hypotheses were confirmed in this study which is illustrated in Table 6. Almost every hypothesis which is related to *Intention to Use* was rejected except for *H7*. As described in the methodology section, further regression analysis was conducted in order to describe which impact a unit change of the explanatory constructs in this framework has on the dependent constructs. The results will be presented and discussed in the next section.

Table 6. Hypotheses outcomes in this study

Hypotheses	***Description***	***Result***
H1	There is a significant, positive relationship between *System Quality* and *Intention to Use*.	No
H2	There is a significant, positive relationship between *Information Quality* and *Intention to Use*.	No
H3	There is a significant, positive relationship between *Service Quality* and *Intention to Use*.	No
H4	There is a significant, positive relationship between *System Quality* and *User Satisfaction*.	Yes
H5	There is a significant, positive relationship between *Information Quality* and *User Satisfaction*.	Yes
H6	There is a significant, positive relationship between *Service Quality* and *User Satisfaction*.	Yes
H7	There is a significant, positive relationship between *User Satisfaction* and *Intention to Use*.	Yes
H8	There is a significant, positive relationship between *Use* and *User Satisfaction*.	Yes
H9	There is a significant, positive relationship between *Use* and *Net Benefits*.	No
H10	There is a significant, positive relationship between *User Satisfaction* and *Net Benefits*.	Yes
H11	There is a significant, positive relationship between *Net Benefits* and *Intention to Use*.	No
H12	There is a significant, positive relationship between *Net Benefits* and *User Satisfaction*.	Yes

5.3. Multiple regression analysis results

Summarizing the interrelationships that DeLone and McLean (2003) propose in Figure 1, there are four major analysis paths which are listed in Table 7.

Before discussing the outcomes of the regression analysis, the regression models will be discussed. The regression models were all found significant with a p-value < 0.001 for the paths 2–4 and p-value < 0.05 for path 1. Considering the outcomes of the descriptive results and the correlation analysis the higher p-value in path 1 does not surprise as it is concerned with *Intention to Use*. Therefore, the significantly lower goodness-of-fit of path 1 compared to paths 2–4 are plausible. Nevertheless, no auto-correlation was identified in all regression paths based on acceptable Durbin-Watson statistics (Mansfield & Helms, 1982). As the VIF values were also acceptable similar to the correlation coefficients, no multicollinearity was identified in this study (Mansfield & Helms, 1982).

Table 7. Multiple regression analysis results

Path	*Variables*		*Model*					*ANOVA*					*Regression*					
No.	*Dependent*	*Independent*	*R*	R^2	*Adj.* R^2	*SE*	*Durb. Wats.*	*SS*	*df*	*MS*	*F*	*p*	*B*	*SE B*	*β*	*t*	*p*	*VIF*
1	Intention to Use	System Quality	0.377	0.142	0.090	0.608	1.923	5.091	5	1.018	2.750	0.024	0.177	0.129	0.167	1.369	0.175	1.445
		Information Quality											0.083	0.196	0.062	426	0.671	2.082
		Service Quality											-0.323	0.133	-0.317	2.43	0.017	1.645
		User Satisfaction											0.339	0.146	0.331	2.330	0.022	1.950
		Net Benefits											-0.047	0.176	-0.036	-0.266	0.791	1.734
2	User Satisfaction	System Quality	0.702	0.493	0.462	0.461	1.737	16.524	5	3.305	15.573	<0.001	0.080	0.099	0.077	0.810	0.420	1.440
		Information Quality											0.496	0.151	0.381	3.297	0.001	2.109
		Service Quality											0.104	0.107	0.101	0.969	0.336	1.732
		User Satisfaction											-0.009	0.054	-0.013	-0.157	0.876	1.164
		Net Benefits											0.376	0.131	0.292	2.882	0.005	1.621
3	Use	Intention to Use	0.554	0.307	0.299	0.829	1.755	25.584	1	25.584	37.264	<0.001	0.882	0.523	0.554	6.104	<0.001	1.000
4	Net benefits	Use	0.587	0.344	0.329	0.399	1.919	6.951	2	3.476	21.794	<0.001	-0.001	0.044	-0.001	-0.014	0.989	1.011
		User Satisfaction											0.456	0.069	0.587	6.568	<0.001	1.011

The results of analysis path 1 which is concerned with *Intention to Use* showed a positive significant impact of *User Satisfaction* on *Intention to Use*. On the other hand, a significant negative impact of *Service Quality* on *Intention to Use* was identified. Based on the previous discussion on *Intention to Use* we do not believe that *Service Quality* and *Intention to Use* are negatively interrelated in general. Therefore, researchers are encouraged to examine this relationship in future research. As we already stated that possibly there is no alternative I/S that is appropriate in applying management accounting techniques, we replaced *Intention to Use* with *Use* as the dependent variable in another regression with the same independent variables stated in regression path 1. The results of this analysis were very similar results to those of regression path 2. In particular, *Information Quality* was found to highly affect the *use* of ERP systems with $\beta = 0.457$ at $p = 0.004$. *System Quality* also had a positive, but no significant impact on Use with $\beta = 0.128$ and $p = 0.306$. Considering the strong relationship between *Information Quality* and *User Satisfaction*, *Information Quality* serves as the most critical quality characteristic in this study. The correlation results already indicated a positive significant relationship between *User Satisfaction* and *Net Benefits*. The regression results showed a significant positive β no matter if *User Satisfaction* or *Net Benefits* were the dependent variables (analysis paths 2 and 4 respectively). Therefore, *User Satisfaction* leads to benefits to the company but for achieving benefits that are related to managerial decision-making also increases the satisfaction that users have with the ERP systems that they rely on. Both these findings support the proposed interrelationships of DeLone and McLean (2003) in Figure 1. Similar to what the literature review results indicate, no significant relationship between *use* and *Net Benefits* was identified. Thus, even if it may be mandatory to use ERP software to apply management accounting techniques, the satisfaction of the users, in this case of decision-makers, should be at an appropriate level in order to achieve benefits to the company. As *Information Quality* was identified as the most critical quality characteristic that affects *User Satisfaction*, the results indicate that an appropriate application of management accounting techniques in order to provide high-quality information that is relevant for decision-making is more critical to the companies' success than the *System Quality* itself.

6. LIMITATIONS

Our study is subject to several limitations: Initially, the study was conducted with only one respondent per company as a quantitative study. In addition, the survey was limited to the geographical area of Germany. Regression models were used for the analysis, testing with structural equation models (SEM) was considered unsuitable for this question.

7. CONCLUSION

This study has examined the success that the use of ERP systems within management accounting offers to companies. All in all, the results may lead to the conclusion that simply using ERP systems is not sufficient for generating success for the companies.

Technical characteristics were found to have a less significant impact on the companies' success than the quality of the information that is being provided from management accounting based on ERP systems. Thus, we recommend companies measure the quality of the reports that are provided by the management accountants from the perspective of decision-makers. A possible approach is to conduct the accounting information criteria which was also considered in this study. From a technical point of view, the adoption of modern ERP software may also support increasing Information Quality and System Quality as the mean values significantly differ from other ERP software products. However, the adoption of new ERP systems is complex and expensive which should be carefully evaluated. The outcomes of this study should be validated by future research in this research field. The D&M I/S success model serves as an appropriate framework to measure the overall success of ERP systems. As the framework is adoptable to various purposes of research, many other frameworks such as the accounting information criteria (Snavely, 1967) or the ERP benefits framework (Shang & Seddon, 2000, 2002) can be integrated in order to operationalize the *quality*, *use* and *benefit* constructs of DeLone and McLean (2003).

REFERENCES

1. Anthony, R. N. (1965). *Planning and control systems: A framework for analysis.* Boston, MA: Harvard University.
2. Bailey, J. E., & Pearson, S. W. (1983). Development of a tool for measuring and analyzing computer user satisfaction. *Management Science, 29*(5), 530–545. https://doi.org/10.1287/mnsc.29.5.530
3. Barki, H., & Huff, S. L. (1985). Change, attitude to change, and decision support system success. *Information & Management, 9*(5), 261–268. https://doi.org/10.1016/0378-7206(85)90050-3
4. Brynjolfsson, E. (1996). The contribution of information technology to consumer welfare. *Information Systems Research, 7*(3), 281–300. https://doi.org/10.1287/isre.7.3.281
5. Cameron, K. S., & Whetten, D. A. (1983). *Organizational effectiveness: A comparison of multiple models*. New York, NY: Academic Press.
6. Chang, H., Ittner, C. D., & Paz, M. T. (2014). The multiple roles of the finance organization: Determinants, effectiveness, and the moderating influence of information system integration. *Journal of Management Accounting Research, 26*(2), 1–32. https://doi.org/10.2308/jmar-50802
7. Clemons, E. K., Reddi, S. P., & Row, M. C. (1993). The impact of information technology on the organization of economic activity: The "move to the middle" hypothesis. *Journal of Management Information Systems, 10*(2), 9–35. https://doi.org/10.1080/07421222.1993.11517998
8. Cohen, J., Cohen, P., West, S. G., & Aiken, L. S. (2003). *Applied multiple regression/correlation analysis for the behavioral sciences* (3rd ed.). https://doi.org/10.4324/9780203774441
9. Coombs, H. M., Hobbs, D., & Jenkins, D. E. (2005). *Management accounting: Principles and applications*. London, the UK: SAGE Publications.
10. Davenport, T. H. (2014). *Big data at work: Dispelling the myths, uncovering the opportunities*. Boston, MA: Harvard Business Review Press.
11. DeLone, W. H., & McLean, E. R. (1992). Information systems success: The quest for the dependent variable. *Information Systems Research, 3*(1), 60–95. https://doi.org/10.1287/isre.3.1.60
12. DeLone, W. H., & McLean, E. R. (2003). The DeLone and McLean model of information systems success: A ten-year update. *Journal of Management Information Systems, 19*(4), 9–30. https://doi.org/10.1080/07421222.2003.11045748
13. Durbin, J., & Watson, G. S. (1950). Testing for serial correlation in least squares regression: I. *Biometrika, 37*(3–4), 409–428. https://doi.org/10.2307/2332391
14. Farrar, D. E., & Glauber, R. R. (1967). Multicollinearity in regression analysis: The problem revisited. *The Review of Economics and Statistics, 49*(1), 92–107. https://doi.org/10.2307/1937887
15. Granlund, M., & Malmi, T. (2002). Moderate impact of ERPS on management accounting: A lag or permanent outcome? *Management Accounting Research, 13*(3), 299–321. https://doi.org/10.1006/mare.2002.0189
16. Haddara, M., & Elragal, A. (2011). ERP Lifecycle: When to Retire Your ERP System? In M. M. Cruz-Cunha, J. Varajão, P. Powell, & R. Martinho (Eds.), *ENTERprise Information Systems* (pp. 168–177). https://doi.org/10.1007/978-3-642-24358-5_17
17. Hitt, L., Brynjolfsson, E., & Walsham, G. (1994). The three faces of IT value: Theory and evidence. *ICIS 1994 Proceedings*, 263–278. Retrieved from https://core.ac.uk/download/pdf/301364305.pdf
18. Holsapple, C., Sena, M., & Wagner, W. (2017). The perceived success of ERP systems for decision support. *Information Technology and Management, 20*, 1–7. https://doi.org/10.1007/s10799-017-0285-9
19. Horváth & Partners. (2013). *Planungsstudie 2012 — Effizienzsteigerung im Fokus.* Retrieved from https://docplayer.org/6917073-Planungsstudie-2012-effizienzsteigerung-im-fokus.html
20. Horváth & Partners. (2015). *Planungsstudie 2015: Ergebnispräsentation (Auszug).* Retrieved from https://docplayer.org/63613884-Planungsstudie-2015-ergebnispraesentation-auszug.html
21. Hsiao-Hui Wang, E. & Chen, C.-Y. (2011). System quality, user satisfaction, and perceived net benefits of mobile broadband services. *Proceedings of the 8th International Telecommunication Society Asia-Pacific Regional Conference Taiwan*, 26–29. Retrieved from https://www.econstor.eu/bitstream/10419/52334/1/673007502.pdf
22. Hyvönen, T. (2003). Management accounting and information systems: ERP versus BOB. *European Accounting Review, 12*(1), 155–173. https://doi.org/10.1080/0963818031000087862
23. Institute of Management Accounting (IMA). (2013). *Our mission — About the profession.* Retrieved from https://www.imanet.org/about-ima?ssopc=1
24. International Group of Controlling (IGC). (2013). *Das Controller-Leitbild der IGC.* Retrieved from https://www.icv-controlling.com/fileadmin/Verein/Verein_Dateien/Sonstiges/Das_Controller-Leitbild.pdf
25. Ishman, M. (1998). Measuring information success at the individual level in cross-cultural environments. *Information Resources Management Journal, 9*(4). https://doi.org/10.4018/IRMJ.1996100102

26. Janssens, G. (2017). *Understanding complexity of ERP implementations: Exploration of three complexity research approaches*. Retrieved from https://www.ou.nl/documents/40554/111715/Understanding_complexity_of_ERP_implementations_Guy_Janssens_171013.pdf/c323ad6b-fdab-3760-b0f2-b25cc06e285f
27. King, W. R., & Epstein, B. J., (1983). Assessing information system value: An experimental study. *Decision Sciences, 14*(1), 34–45. https://doi.org/10.1111/j.1540-5915.1983.tb00167.x
28. Krüger, J. (2016). *SAP S/4HANA finance: An introduction.* (2nd ed.). Bonn, Germany: Rheinwerk Publishing.
29. Mansfield, E. R., & Helms, B. P. (1982). Detecting multicollinearity. *The American Statistician, 36*(3a), 158–160. https://doi.org/10.1080/00031305.1982.10482818
30. Mason, R. O. (1978). Measuring information output: A communication systems approach. *Information & Management, 1*(4), 219–234. https://doi.org/10.1016/0378-7206(78)90028-9
31. Myers, B. L., Kappelman, L. A., & Prybutok, V. R. (1997). A comprehensive model for assessing the quality and productivity of the information systems function: Toward a theory for information systems assessment. *Information Resources Management Journal, 10*(1), 6–26. https://doi.org/10.4018/IRMJ.1997010101
32. O'Mahony, A., & Doran, J. (2009). The changing role of management accountants; evidence from the implementation of ERP systems in large organisations. *International Journal of Business and Management, 3*(8), 109–115. https://doi.org/10.5539/ijbm.v3n8p109
33. Petter, S., & McLean, E. R. (2009). A meta-analytic assessment of the DeLone and McLean IS success model: An examination of IS success at the individual level. *Information & Management, 46*(3), 159–166. https://doi.org/10.1016/j.im.2008.12.006
34. Petter, S., DeLone, W., & McLean, E. (2008). Measuring information systems success: Models, dimensions, measures, and interrelationships. *European Journal of Information Systems, 17*(3), 236–263. https://doi.org/10.1057/ejis.2008.15
35. Pitt, L. F., Watson, R. T., & Kavan, C. B. (1995). Service quality: A measure of information systems effectiveness. *MIS Quarterly, 19*(2), 173–187. https://doi.org/10.2307/249687
36. Rom, A., & Rohde, C. (2007). Management accounting and integrated information systems: A literature review. *International Journal of Accounting Information Systems, 8*(1), 40–68. https://doi.org/10.1016/j.accinf.2006.12.003
37. Rousseeuw, P. J., & van Zomeren, B. C. (1990). Unmasking multivariate outliers and leverage points. *Journal of the American Statistical Association, 85*(411), 633–639. https://doi.org/10.2307/2289995
38. Sabherwal, R., Jeyaraj, A., & Chowa, C. (2006). Information system success: Individual and organizational determinants. *Management Science, 52*(12), 1849–1864. https://doi.org/10.1287/mnsc.1060.0583
39. Scapens, R. W., & Jazayeri, M. (2003). ERP systems and management accounting change: Opportunities or impacts? A research note. *European Accounting Review, 12*(1), 201–233. https://doi.org/10.1080/0963818031000087907
40. Seddon, P. B. (1997). A respecification and extension of the DeLone and McLean model of IS success. *Information Systems Research, 8*(3), 240–253. https://doi.org/10.1287/isre.8.3.240
41. Shang, S., & Seddon, P. B. (2000). A comprehensive framework for classifying the benefits of ERP systems. *AMCIS Proceedings 2000*, 1004–1013. Retrieved from https://aisel.aisnet.org/amcis2000/39
42. Shang, S., & Seddon, P. B. (2002). Assessing and managing the benefits of enterprise systems: The business manager's perspective. *Information Systems Journal, 12*(4), 271–299. https://doi.org/10.1046/j.1365-2575.2002.00132.x
43. Shannon, C. E. (1948). A mathematical theory of communication. *Bell System Technical Journal, 27*(3), 379–423. https://doi.org/10.1002/j.1538-7305.1948.tb01338.x
44. Snavely, H. J. (1967). Accounting information criteria. *The Accounting Review, 42*(2), 223–232. Retrieved from https://www.jstor.org/stable/243928
45. Spraakman, G., O'Grady, W., Askarany, D., & Akroyd, C. (2018). ERP systems and management accounting: New understandings through "nudging" in qualitative research. *Journal of Accounting & Organizational Change, 14*(2), 120–137. https://doi.org/10.1108/JAOC-06-2016-0038